

Abstracts of Memoirs

RECORDING WORK DONE AT THE PLYMOUTH LABORATORY.

Abstracts of Papers by **W. R. G. Atkins, O.B.E., Sc.D., F.I.C.**
 some with **Miss M. V. Lebour, D.Sc.**, and one with **Mr. E. W. Fenton, M.A., B.Sc.**, Seale-Hayne Agricultural College.

THE hydrogen ion concentration of any chemical compound or mixture of compounds is an important factor, inasmuch as it is related to the solubility of substances of low solubility, to the activity of enzymes and to the state of aggregation and chemical behaviour of many other colloidal substances. The series of papers abstracted here constitutes an attempt to trace these relationships as affecting a number of biological problems. The papers dealing with applications to marine biology have been printed in full in this Journal.

1. Relation of Hydrogen Ion Concentration of the Soil to Plant Distribution.

By **W. R. G. Atkins.**

Nature, 1921, Vol. 108, p. 80, Sept. 15th.

2. Some Factors affecting the Hydrogen Ion Concentration of the Soil and its relation to Plant Distribution.

By **W. R. G. Atkins.**

Sci. Proc. Roy. Dublin Soc. (N.S.), 1922, Vol. 16, pp. 369-413, and *Notes, Bot. School, Trinity Coll., Dublin*, 1922, Vol. 3, No. 3.

3. The Hydrogen Ion Concentration of Plant Cells.

By **W. R. G. Atkins.**

Loc. cit., pp. 414-426, and *loc. cit.*, No. 3.

4. Note on the Occurrence of the Finger and Toe Disease of Turnips in relation to the Hydrogen Ion Concentration of the Soil.

By **W. R. G. Atkins.**

Loc. cit., pp. 427-428, with *Bibliography for the three papers*, pp. 429-434, and *loc. cit.*, No. 3.

5. The Hydrogen Ion Concentrations of some Indian Soils and Plant Juices.

By **W. R. G. Atkins.**

Agric. Research Institute, Pusa, 1922, Bull. No. 136, pp. 1-12.

6. Some Physical and Chemical Factors which affect Plant Distribution.

By **W. R. G. Atkins.**

Ann. Rep. of Brit. Assoc., 1922, Sect. K.

The soils studied lay between pH4.1 and pH9.0, peaty soils being at the acid and the calcareous silts of Behar, India, at the alkaline end. The reaction of the natural waters of the districts studied varied from pH5.0 for the amber water of a bog pool to pH9.7 for a pond containing calcium and magnesium salts during the active photosynthesis of abundant algæ. Calcium carbonate in the absence of free carbon dioxide or of bicarbonate produces a reaction of pH9.0, whereas for magnesium carbonate the value is pH10.0. Soil alkalinity of over pH10, due to sodium carbonate, may be reduced to pH8 by the addition of gypsum, and thus a reaction which is injurious or destructive may be converted into one that is favourable to most plants.

Records given for the hydrogen ion concentration of the habitats of over a hundred plants show that many plants are limited to a short range of pH values. Others, with a wider range, occur mainly in one portion of it, but some plants grow well at widely different soil reactions.

Adjacent fields of similar clay soil were found to be badly infested with and free from finger and toe disease in the turnip crop. It was found that they contained, respectively, 0.17 and 0.40 per cent of calcium, calculated as oxide. The hydrogen ion concentrations were respectively 0.25 and 0.20×10^{-6} grams per litre, or pH6.6 and 6.7 or slightly over. An adjoining garden at pH7.8 was also free from the disease, though treated with farmyard manure infected from turnip feeding.

In addition to the measurements on the sap of algæ (this Journal, 1922, 12, 785), which were found to lie between pH6.3 and 7.3, determinations were made on a number of land plants. The greatest concentration, pH1.4, was found in an unidentified berry, like a gooseberry, produced by a large Indian tree. All the tissues examined lay on the acid side of neutrality, parenchyma being often about pH6 and the xylem more acid as seen in cross-sections stained with appropriate indicators.

The transpiration stream was found to be almost neutral, but digestive secretions, such as those of *Sarracenia*, *Nepenthes* and *Drosera*, may be more acid than pH5. The hydrogen ion concentration met with in a tissue was, in the cases studied, usually near, but slightly less than, the optimum for the activity of the characteristic enzyme at air temperature. This ensures that the acidity does not destroy the enzyme at such higher temperatures as may be experienced by the plant under natural conditions.

7. The Hydrogen Ion Concentration of Natural Waters and some Etching Reagents in relation to Action on Metals.

By W. R. G. Atkins.

Trans. Faraday Soc., 1923, Vol. 18, pp. 310-317.

8. The Hydrogen Ion Concentration of the Soil in relation to the Flower Colour of *Hydrangea hortensis* W., and the Availability of Iron.

By W. R. G. Atkins.

Sci. Proc. Roy. Dublin Soc., 1923, Vol. 17, pp. 201-210, and Notes,
Bot. School, Trinity Coll., Dublin, 1923, Vol. 3, No. 4.

Attention is drawn to the possible utility as etching reagents of buffer mixtures and of acids of relatively low hydrogen ion concentration, since the hydroxides of the metals begin to be precipitated at different pH values, as for example, copper pH5, ferric iron pH3.5, ferrous iron pH5.1, the precise value being largely affected by the concentration of the metallic ion.

Ferrous salts in solution become more acid on standing, with precipitation of ferric hydroxide. The latter is completely precipitated before ferrous hydroxide, as the solution is made more alkaline. These facts are considered in relation to the rusting of iron. The precipitation of ferrous hydroxide is incomplete even at pH7.1, hence a trace of acid suffices to attack iron, and the hydroxide produced through hydrolysis is oxidised and precipitated. The hydrolysis equilibrium is thereby upset and acid is regenerated. Thus provided oxygen is available the cycle is again begun, but in its absence the acid is not regenerated and further corrosion ceases. These precipitation limits for ferrous and ferric salts have a direct bearing upon the formation of iron pan in soil, since the iron in solution percolates into the less acid subsoil, and is there precipitated, the ferrous hydroxide becoming in time oxidised.

The common hydrangea acts as a guide to the amount of iron in solution in the soil water, since it produces blue flowers in soil at about pH5.7 to 6 or over, and pink flowers at and above pH7.5, with mixed blue and pink and intermediate shades in between. The blue flowers are richer in iron than are the pink, as shown by quantitative analysis and by Macallum's hæmatoxylin test. The difference in the colour of the flowers is not due to the natural pigment acting as an indicator, since blue and pink flowers from the same plant were both at pH4.2.

9. The Hydrogen Ion Concentration of the Soil in relation to Animal Distribution. By W. R. G. Atkins.

Nature, 1921, Vol. 108, p. 568, Dec. 29th.

10. Measurements of the Acidity and Alkalinity of Natural Waters in their Biological Relationships. By W. R. G. Atkins.

Salmon and Trout Magazine, 1922, pp. 184-198, Sept.

11. The Hydrogen Ion Concentration of Soils and Natural Waters in relation to Animal Distribution. By W. R. G. Atkins.

Rep. British Assoc., 1922, Sect. D.

12. **Soil Reaction, Water Snails, and Liver Flukes.**
By **W. R. G. Atkins and M. V. Lebour.**
Nature, 1923, *Vol.* 111, *p.* 83, *Jan.* 20th.
13. **The Hydrogen Ion Concentration of the Soil and of Natural Waters in relation to the Distribution of Snails.**
By **W. R. G. Atkins and M. V. Lebour,**
Sci. Proc. Roy. Dublin Soc., 1923, *Vol.* 17, *pp.* 233–240.
14. **The Habitats of *Limnæa truncatula* and *L. pereger* in relation to Hydrogen Ion Concentration.** By **W. R. G. Atkins and M. V. Lebour.**
Loc. cit., 1924, *Vol.* 17, *pp.* 327–331.

Since many animals, especially insects, are associated with particular plants, it is obvious that since the pH value may limit the distribution of the plant it may also do the same for the animal. Apart from this, however, an increase in acidity may in itself exert a harmful effect upon an animal, as for example, in the case of trout, where Kushton has shown that flood water from bogs causes death through coagulation of the mucus of the gills. The distribution of fish food also appears to be regulated by the pH value, both directly by that of the water and indirectly by that of the banks—for land-bred insects form a considerable proportion of the food of fresh-water fishes.

The distribution of snails is largely affected by soil reaction, and they occur in greatest number from pH7–8. The number of species of snails found in the districts studied increases from pH5 four species to pH7 twenty species, falling at pH8 to fourteen out of the total twenty-seven species collected. Snails with hyaline shells may be found in any portion of the range, but those with calcareous shells are limited to the more alkaline end. Granite and quartzite regions have few species, basaltic districts have a more numerous fauna, and in limestone areas both species and numbers of individuals give high values.

There remain over a number of puzzling cases in which, within an area of two square miles, certain species are altogether absent from one locality, though abundant in others, in spite of similarity in pH value, salt content of soil, and aspect. A difference only of exposure to wind could be noted.

The habitats of *L. pereger* and *L. truncatula* appear to differ in the fact that whereas the former is truly a water-snail, and can endure even somewhat stagnant water, the latter is amphibious, and can live either in shallow, well-aerated water or on moist land, or even on cliffs in a region of high humidity.

The observed ranges for the two species are almost identical as regards reaction and salt content of the water (as shown by electrical-conduc-

tivity), those for *L. pereger* being pH6·6–7·7 and $C=72-227 \times 10^{-6}$ at 0°C., and for *L. truncatula* pH6·4–7·8 and $C=59-294 \times 10^{-6}$. It is noticeable that the records include neither upland waters of very low salt content with conductivity $20-30 \times 10^{-6}$, nor regions of high acidity.

15. **The Differentiation of Boiled and Unboiled Water.** By W. R. G. Atkins.

Nature, 1921, Vol. 108, p. 339, Nov. 10th.

16. **The Hydrogen Ion Concentration of Natural Waters in relation to Disease.**

By W. R. G. Atkins.

Journ. of State Medicine, 1923, Vol. 31, pp. 223–226.

17. **The Hydrogen Ion Concentration of the Soil and Natural Waters in relation to Diseases other than Bacterial.** By W. R. G. Atkins.

Parasitology, 1923, Vol. 15, pp. 205–210.

Boiling drives off free carbon dioxide and decomposes bicarbonates, so water is more alkaline after boiling than before, as may readily be shown by an appropriate indicator. It is therefore possible to keep a check upon whether or no orders as to boiling drinking water have been carried out.

With the exception of bog waters and those abnormally rich in metallic salts it seems that naturally occurring waters are at pH values favourable to the continued existence of the *Vibrio cholerae* and bacilli of the typhoid group. The suggestion is made that water may be rendered safe for drinking purposes by rendering it as alkaline as pH10·5, or thereabouts, by adding ash derived from vegetable matter, which is rich in carbonates of potassium and sodium. Temperatures should also be stated when limiting, and optimal pH values are given for the growth of various organisms.

Facts known as to the relation between pH values of soil and water may possibly be applied to explain the distribution of malarial fever, as illustrating insect-borne disease, and that of some of the numerous Trematode infections, afflicting man and other animals, in which snails act as intermediate hosts, viz. bilharziosis, the Japanese skin disease "kabure," liver fluke disease, the disease in fish due to *Lissorchis fairporti* Magath., and that in the human lung occasioned by *Paragonimus westermani*.

18. **Seasonal Changes in Water in relation to the Algal Plankton.**

By W. R. G. Atkins.

Rep. Brit. Assoc., 1923, Sect. K.

This is a brief account of the changes in pH and in phosphate content, as already published in full in this Journal.

19. **The Hydrogen Ion Concentration of the Soil in relation to the Distribution of Pasture Plants.** By W. R. G. Atkins and E. W. Fenton.

Rep. Brit. Assoc., 1923, Sect. M.

Following the lines of Nos. 1 and 2 of these abstracts provisional results are given for the pH values at which species of grasses and clovers occur and are most abundant. Since in practice species sown are usually crowded out in a few years by others native to the soil, such an investigation appeared to be desirable. It was ascertained that wild white clover might occur in sites as acid as pH5.6, whereas *Medicago maculata* was found from pH6.7-7.8. A few values for grasses are also recorded.

W. R. G. A.

Haplosporidium nemertis nov. sp. By P. Debaisieux.

C. R. Soc. Biol., Paris, T. LXXXII, 1919, pp. 1399-1400.

The author describes the existence of a new Sporozoan, *Haplosporidium nemertis*, in *Lineus bilineatus* MacIntosh. The parasites are extremely abundant in the infected hosts. The spores are protected by an ovoid membrane which is differentiated into a movable valve at one of its poles; they contain a single nucleus, comparatively large. The life-history of the parasite is briefly described, and allows the species to be placed among the Haplosporidia.

P. D.

Quelques Protozoaires parasites des Chitons et des Patelles.

By P. Debaisieux.

C. R. Soc. Biol., Paris, T. LXXXII, 1919, pp. 1400-1402.

In the molluscs, Chitons and Limpets, certain stages of sporozoa have been known for some time. Their study has led several authors (Ray Lankester, 1891; Labbé, 1899; Mrs. Pixell Goodrich, 1915) to interpret in different ways the systematic position of these parasites. The careful study of different stages observed in molluscs found in the neighbourhood of Plymouth has enabled the author to distinguish clearly several species, *Pseudoklossia chitonis* nov. sp. and an *Eimeridea* in *Acanthochiton fascicularis* L.; *Haplosporidium (Minchinia) chitonis* in *Craspidochilus cinereus* L.; *Pseudoklossia patellæ* nov. sp. in *Patella vulgaris*.

P. D.

Haplosporidium (Minchinia) chitonis Lank., Haplosporidium nemertis nov. sp., and the group of Haplosporidia. By P. Debaisieux.

La Cellule, T. XXX, fasc. 2, 1920, pp. 291-313. 2 Figures.

In this work the detailed study of two Haplosporidia discovered at Plymouth is given, the one in *Lineus bilineatus*, the other in *Craspidochilus cinereus*. Both species have young stages, which are intracellular and generally binucleate; by nuclear division these parasites give rise to large plasmodia in which the paired nuclei increase considerably. These nuclei divide by a very characteristic mitosis, with a very marked intracellular spindle, with an intranuclear corpusele (Karyosome?) separating off and dividing at the moment of anaphase. The large nuclei divide a certain number of times without increasing in size, so that finally the plasmodium contains a number of small nuclei; the protoplasm fragments and the plasmodium splits up into spores. The author endeavoured to interpret the significance of all the observed stages and to establish the life-history of the species studied. He discusses at length the affinities of the genus and attaches it to the Microsporidia. He extends the discussion to the whole group of Haplosporidia, considerably diminishes the importance of the group, and finally reduces it to a few species about which little is known.

P. D.

Note sur deux Coccidies des Mollusques: Pseudoklossia (?) patellæ et P. chitonis. By P. Debaisieux.

La Cellule, T. XXXII, fasc. 2, pp. 231-246. 1 Plate.

In this work the author undertook the cytological study of two Coccidia found in Limpets and Chitons (*Acanthochiton fascicularis*). He establishes the differences, chiefly in size, existing between the two species and then describes their life history. True schizogony appears to be lacking, but it is replaced by an asexual multiplication into successive halves. Gametogenesis (macrogametes and microgametes) was observed, but not the development of the spores; it probably occurs outside the body of the host. With this gap in the knowledge of the life-history of these two Coccidia it is impossible to classify them definitely. Meanwhile what we know of their development allows us to place them very near to, and probably in, the genus *Pseudoklossia* of Léger and Dubosq.

P. D.

Nuclear Division in the Dinoflagellate, *Oxyrrhis marina* Duj.

By J. S. Dunkerly, B.Sc.

Proc. Roy. Phys. Soc. Edin., 20, 1921, pp. 217-220.

Nuclear division as seen in *Oxyrrhis marina*, which occurred plentifully in tank material from Plymouth grown in Allen and Nelson culture

medium, is of the type known as promitosis, with a karyosome acting as a division centre, massive chromatin plates with numerous threadlike chromosomes and clear polar caps to the division spindle. The division figures resemble those of other Dinoflagellates, e.g. *Ceratium*, with the important difference that the karyosome does not appear to act as division centre in *Ceratium*. *Oxyrrhis*, therefore, is of a more primitive type, as regards nuclear division, than other Dinoflagellata, and is in this respect intermediate between them and the Euglenoidina.

J. S. D.

Rhabdamoeba marina gen.n. et sp.n. By J. S. Dunkerly, B.Sc.

Proc. Roy. Phys. Soc. Edin., 20, 1921, pp. 220-221.

A very small (7.5 μ diam.) amoeboid form with minute spiny projections on the pseudopodia was found in preparations made of the surface film organisms in a culture of *Oxyrrhis marina* in sea water with Allen and Nelson medium. No details of its life-history were made out, but its form distinguishes it as a new type of organism, while its small size and extreme transparency may explain its previous non-discovery.

J. S. D.

Fish Myxosporidia from Plymouth. By J. S. Dunkerly, B.Sc.

Parasitology, 12, 1921, pp. 328-333.

An examination was made of the Myxosporidia found parasitic in marine fish, especially of the forms inhabiting the gall-bladder of their host. Three hundred and twenty fish belonging to forty-six species were examined. Of these, eighty-three individuals belonging to fifteen species proved to be infected with Myxosporidia, of which fifteen species were identified, five of them being described as new. A further paper dealing with some of the results of this work has now been prepared.

J. S. D.

The Preparation of Dogfish for Market. By E. Ford, A.R.C.Sc.

Fish. Board, Scotland, 1923.

This pamphlet, written for the Fishery Board for Scotland, provides an account of the preparation at Plymouth market of dogfish for sale as Flake. The market arrangements for the employment and payment of gutters and for the disposal of the large amount of offal, are dealt with, and the descriptions of the successive stages in the operations of gutting, skinning, beheading and packing, are accompanied by text figures.

E. F.

An Investigation into the Cause of the Spontaneous Aggregation of Flagellates and into the Reactions of Flagellates to dissolved Oxygen.

By **H. Munro Fox.**

Parts I and II, Journ. Gen. Physiol., III, 1921, pp. 483-511.

Methods of studying the Respiratory Exchange in small, aquatic organisms, with particular reference to the use of Flagellates as an Indicator of Oxygen Consumption. By H. Munro Fox.

Journ. Gen. Physiol., III, 1921, pp. 565-573.

A flagellate, *Bodo sulcatus*, forms aggregations in regions where the concentration of dissolved oxygen has a certain value. This value is less than the saturation concentration of oxygen dissolved in water under atmospheric partial pressure. The flagellates move out of regions where the oxygen concentration is above or below the optimum to gather into the optimal regions. They are positively chemotactic to a certain concentration of dissolved oxygen.

This behaviour of the flagellates can be made use of to indicate changes in the concentration of dissolved oxygen due to the respiration of an aquatic organism present in the water. For if the organism under investigation be kept motionless in a suspension of the flagellates in water with oxygen at the atmospheric partial pressure, the flagellates will collect into those regions where the oxygen concentration is lowered through the respiratory activity of the organism. The sizes of the aggregations of flagellates thus formed will show the relative amounts of oxygen absorbed by the different parts of the surface of the organism.

H. M. F.

The Genus *Polysiphonia* Grev., a critical Revision of the British Species, based upon Anatomy. By Lily Batten, M.Sc., Ph.D.

Linnean Society's Journal, Botany, Vol. XLVI, April, 1923, pp. 271-311.

Species of British *Polysiphonia* may be classified according to their anatomical differentiation. The thallus consists of a central siphon, surrounded by four or more pericentral siphons. In the corticate forms, external cells are also present which do not extend individually for the complete length of an articulation. Protoplasmic continuity is present throughout the plant in the young stages, although later some of the connecting pits may become closed. The form of the attachment organ varies with the species, and is influenced by the nature of the substratum. Four types may be distinguished:—

1. The ecorticate plant is originally attached by rhizoids which are developed from siphons by longitudinal proliferation. Later, siphons of

procumbent branches also develop rhizoids, the tips of which may be modified in various ways.

2. Species which show the elementary aggregation of the rhizoids to form a large disc.

3. *P. fruticulosa*, which is originally attached by a number of longitudinally developed rhizoids, and later certain stunted procumbent branches function specially in the formation of the attachment organ.

4. Species with an upright habit, which do not branch near the base, develop a large disc-like expansion at the base of the thallus.

A classification and description of the individual species follows, together with a key for identification.

L. B.

On a new type of Teleostean Cartilaginous Pectoral Girdle found in young Clupeids. By E. S. Goodrich, F.R.S.

Journ. Linn. Soc. Zool., Vol. 34, pp. 505-509.

In the young of *Clupea sprattus*, *C. harengus* and *C. pilchardus* about 20-30 mm. in length, the right and left coracoid regions fuse to a solid cartilaginous ventral bar, which becomes bent and again subdivided in later stages. This fusion is probably a specialisation to strengthen the support of the pectoral fins before the complete development of the dermal bones of the pectoral girdle.

E. S. G.

The Spore of Thelohania. By H. L. M. Pixell Goodrich, D.Sc.

Arch. Zool. Exp. et Gen., Vol. LIX, Notes et Revue, No. 1, 1920, pp. 17-19.

A prawn, *Leander (Palaemon) serratus*, from the tanks at Plymouth Aquarium had opaque white muscles, and seemed obviously infected with *Thelohania octospora*. The spores, however, were all provided with three long tails as well as a polar capsule. This, the first recorded instance of a tailed spore occurring among true Microsporidia, furnishes a point of resemblance between these parasites with minute spores provided with a polar filament and the family Haplosporidiidæ, many members of which have tailed spores, but never a polar filament.

H. L. M. P. G.

Some Notes on Leander longirostris M. Edwards, and other British Prawns.

By R. Gurney, M.A., F.L.S.

Proc. Zool. Soc., 1923, pp. 97-123.

Some account is given of the specific characters, distribution and breeding periods of the British Palaemonidæ. To the four species recorded

as British a fifth, *L. longirostris* M. Edw., may now be added. This species, which has recently been redescribed by De Man,* is common in Dutch estuarine waters and also in the Norfolk rivers Waveney, Yare and Bure, which discharge into Breydon Water. It has not been found elsewhere in Britain. It is a river prawn, equally at home in salt or in fresh water, but it goes down to salt water to hatch out its larvæ which are never found in the rivers. De Man has now† separated the Dutch form (with which the Norfolk prawns agree), as a new variety *robusta*, from the typical form of Milne Edwards.

L. serratus differs from all the other species in its breeding period, which begins in the winter, larvæ being found from December onwards. Any Leander larvæ taken before June may confidently be referred to this species for this reason alone.

The pleopods of the female undergo certain changes at the time of oviposition in all the species, developing peculiar ovigerous setæ which are absent at other seasons.

In *L. squilla* and *L. longirostris* there appear to be two broods produced during the breeding season, but it is doubtful if there is more than one as a rule in *Palæmonetes varians*.

R. G.

A Note on the Physiology of the Shipworm (*Teredo norvegica*).

By C. R. Harington.

Biochem. Journ., Vol. XV, 1921, pp. 736-741.

Preliminary experiments *in vitro*, to determine the toxicity to *Teredo* of different substances which might conceivably be used in the impregnation of timber, showed that certain aromatic nitro-compounds were highly toxic; promising results were also obtained with carbazol and with an arsenic derivative of diphenylamine. A series of sea-tests was started to determine the efficacy of these various substances under the conditions of actual use.

C. R. H.

Report on Work done at the Marine Biological Station, Plymouth, July 1st to September 18th, 1920. By C. R. Harington.

Dept. Scient. and Industrial Research. Deterioration of Structures in Sea-water. Second (Interim) Report of the Committee of the Inst. C.E., 1922, pp. 35-42.

A series of experiments was carried out in relation to various aspects of the physiology of *Teredo* which might have a bearing upon the protection of timber against its attacks. It was attempted to rear *Teredo* from

* *Tijdschr. Ned. Dierk. Vereen* (2), XIV, 1915-1916. † *Ibid.* (2), XIX, 1923.

the larval stage in the Laboratory ; although these experiments failed in their primary object, they showed that the duration of the free-swimming stage may be at least as long as a fortnight. The study of the larvæ during their free-swimming existence brought to light the fact that they were strongly attracted towards wood ; further investigation of this phenomenon showed that this power of attraction was shared by ethereal and alcoholic extracts of sawdust and also by pure malic acid. This suggests the probable mechanism by which the larvæ are led to settle upon timber.

In order to throw some light upon the nutrition of the animal, the enzymes of the digestive gland were briefly investigated. It was found that extracts of the gland possessed marked amylolytic activity, and also were apparently capable of hydrolysing the hemi-cellulose of wood to glucose ; so that *Teredo* would appear to be capable of deriving at least part of its nutriment from the wood-borings which pass through its alimentary canal.

C. R. H.

Further Studies on Restitution-bodies and free Tissue-culture in Sycon.

By Julian S. Huxley.

Q.J.M.S., Vol. LXV, 1921, pp. 293-322.

Confirmation is given of the fact that calcareous sponges can reorganise themselves after their tissues have been dissociated in various ways. Reorganisation consists mainly in the sorting-out of the cells of the two primary layers ; thus in this form of regeneration fate is not a function of position, but position a function of nature.

By various methods an excess of either collar-cells or dermal-cells can be obtained. In the former case hollow spheres of collar-cells may be formed, or segments of spheres protruding from a mass of mixed cells. In the latter case, similar segments of spheres entirely composed of one layer of dermal-cells may be formed. No complete spheres composed of dermal cells were observed. There appears to exist a definite attraction between dermal-cells.

Spontaneous segmentation of restitution masses into smaller masses may occur, simultaneously with the secretion of a gelatinous covering.

A peculiar small finger-shaped amœbocyte is described. J. S. H.

Dedifferentiation in Echinus larvæ, and its relation to Metamorphosis.

By Julian S. Huxley.

Biol. Bull., Vol. XLIII, 1922, pp. 210-234.

In very weak toxic solutions (KCN, HgCl₂), dedifferentiation of Echinus larvæ occurs. This results in the loss of the arms, the closure of mouth.

and anus, and the final attainment of a spherical state in which the internal organs are reduced to a few vesicles with a packing of mesenchyme. The hypothesis is advanced that normal metamorphosis in Echinoids is initiated by the weight of the Echinus rudiment pulling the larva down to the bottom, which is unfavourable to the larval tissues. These then start to dedifferentiate, and are resorbed in favour of the developing adult tissues.

It is pointed out that tissues with large cell-surface are especially sensitive to agents causing dedifferentiation.

In dilute solution the toxic effect of mercury salts is shown to depend upon the total amount present as well as upon the concentration.

J. S. H.

Studies in Dedifferentiation. IV. Resorption and Differential Inhibition in Obelia and Campanularia.

By Julian S. Huxley, M.A. and G. R. de Beer, B.A., B.Sc.

Q.J.M.S., Vol. LXVII, 1923, pp. 473-494.

Details are given of the process by which the hydranths of various hydroids disappear under unfavourable conditions. It is shown that the disappearance is initiated by a true dedifferentiation, which is followed by resorption into the stolon, the cells of the hydranth tissues migrating individually into the cavity. This confirms and extends the work of Loeb, Thacher and others.

Dilute toxic solutions quantitatively accelerate the process. Phagocytosis of nematoblasts and other cells appears to occur, after they have migrated into the cavity.

Resorption is regarded as the natural result of dedifferentiation when there are adjacent cavities into which the cells can migrate. In higher forms it has been largely replaced by phagocytosis.

J. S. H. AND G. R. DE B.

Report on the Life-History of *Hemiurus communis* Odhner.

By M. V. Lebour, D.Sc.

Parasitology, Vol. XV, 1923, pp. 233-235.

A larval Trematode was twice found emerging from *Acartia clausi* taken from tow-nets, one inside and the other outside the Sound. This was identified as *Hemiurus communis*, Odhner, a common species in these regions. Both specimens were in an intermediate stage between cercaria and adult with male organs fully developed and female organs incom-

plete. The adult worm lives inside various fishes, especially gadoids, including *Gadus luscus*, *G. merlangus*, *G. minutus* and *G. pollachius*, and is one of the commonest marine trematodes. So far this is all that is known of its life-history.

M. V. L.

The Comparative Morphology of the Secondary Sexual Characters of Elasmobranch Fishes—the Claspers, Clasper Siphons, and Clasper Glands.

By **W. H. Leigh-Sharpe, M.Sc.**

Memoir I. Journ. Morph., Vol. 34, 1920, pp. 245-265.

The muscular sac called the siphon in *Scyllium*, etc., is homologous with the sac containing the clasper gland in *Raia*. Experiments are given in support of the view that the siphons are normally full of sea water and surrounded by powerful muscles by which spermatozoa already in the clasper grooves are injected into the female and rotated by a fan-like structure. It is the purpose of this and succeeding memoirs to compare together on these points all Elasmobranchs obtainable. Parasiphons are present in *S. catulus*. The histology of the siphon wall, a description of spermatozoa, and some new details of the clasper gland of *Raia* are given, together with remarks on the peculiarities of the striped muscle attached to the clasper gland.

W. H. L.-S.

Memoir II. Journ. Morph., Vol. 35, 1921, pp. 359-380.

The claspers function as penes and should be called such, and while it is beyond doubt that both are inserted together, it is possible that on occasions one may be inserted at a time. The siphons of *Galeus* and *Mustelus* are enormously developed. *Lamna* possesses a peculiar clasper gland unlike that of *Raia*, while the clasper gland of *Rhina* is a mucous gland, as is also the labial "organ." The clasper glands are developed in the same way as prostatic glands, and are homologous with them. The claspers with siphons have strong skeletal supports, and are roughened with denticles to prevent elision, and do not depend upon erection. The claspers with accessory glands are smooth, have much erectile tissue, and but feeble skeletal support, the large rhipidion preventing elision. It is suggested that some part of the gland, or more probably its muscular wall, secretes a metabolite capable of causing vasodilatation. Thus the glands are physiologically similar to prostatic glands. The rectal gland is not a mucous gland, but probably excretory.

W. H. L.-S.

Note on the Systematic Position and Distribution of the Actinian *Sagartia luciae*. By J. Playfair McMurrich, C.M.Z.C.

Proc. Zool. Soc., London, 1921, pp. 729-739.

A study of the anatomical characters of *S. luciae* indicate that it possesses a well-defined fosse, that there is complete absence of a mesogloceal sphincter, and that it possesses only six pairs of perfect mesenteries which are also sterile. It therefore belongs to the sub-family Metridiinae, in which the Aiptasias should be included, but differs generically from any form at present included in that sub-family.

The species has been recorded from the coast of Massachusetts and from Plymouth. Record is now made of its occurrence also on the coast of Vancouver Island, where, as is shown by unpublished drawings made by Mr. Alex. Agassiz, it was observed in 1859. This suggests the possibility of a former circumpolar distribution. Attention is drawn to the great probability of *A. chrysosplenium*, described from Cornwall by Mr. Cocks in 1851, being identical.

The species cannot be assigned to the genus *Sagartia*, of which *S. effata* L. should be taken as the type. Gosse assigned *A. chrysosplenium* to a subgenus *Chrysoela*, and, assuming the identity of the forms known as *S. luciae* with Mr. Cocks' species, they should be known as *Chrysoela chrysosplenium* (Cocks) Gosse.

J. P. McM.

On the Physiology of Amœboid Movement, II. The effect of Temperature.

By C. F. A. Pantin, B.A.

Brit. Journ. Exp. Biol., 1924, Vol. I, No. 4, pp. 519-538.

The velocity of two kinds of marine amœbæ varies with the temperature in the manner characteristic of many other biological processes. Movement is reversibly inhibited near 0°C. There are respective optima temperatures (20°, and 22°-25°) above which activity falls rapidly. This fall ends in irreversible inhibition.

Above the optimum some part of the mechanism, possibly an enzyme, is progressively destroyed by the heat: the rate of destruction rises rapidly with the temperature above the optimum. Below the optimum the velocity rises with the temperature. Were it not for the destructive effect the velocity would continue to rise with the temperature above the optimum. The rise in velocity with temperature is probably general for all forms of amœboid activity.

The mechanics of amœboid activity are considered. It is conceivable that the energy of amœboid activity might be derived *directly* from a chemical reaction. But if this were so the velocity of the reaction would

control the rate at which work was done and not the velocity of locomotion. Calculation of the rate of doing work shows that its temperature coefficient is very high and unlike that found in most biological processes.

On the other hand, the rate at which the protoplasm can change its state from endoplasm (sol) to ectoplasm (gel) may directly control the velocity of an amoeba. If temperature affects the rate of change of state as it does the rate of many other biological processes, we have an explanation of why the *velocity* of an amoeba is affected by temperature in the same way as other processes.

It is therefore suggested that the velocity of an amoeba is not directly controlled by the velocity of a chemical reaction supplying the energy necessary for activity, but that it probably is controlled by the rate at which the protoplasm can change its state.

The temperature coefficient of the velocity indicates that the rate at which the protoplasm can change its state is itself possibly controlled by a chemical reaction. Amoeboid activity would then ultimately depend on this reaction, but only indirectly.

C. F. A. P.

The Structure and Function of the Liver of *Teredo* (the Shipworm).

By F. A. Potts, M.A.

Proc. Cambridge Philosophical Society (Biol.), Vol. I, pp. 1-17, Pls. I and II.

The alimentary canal of this wood-boring form has been described in its morphology and development by Sigerfoos, who does not, however, give any account of the remarkable histology of the "liver." This gland communicates by wide ciliated ducts with the stomach, and its lumen is always filled with fragments of wood. In many of the lobules of the liver the epithelial cells are phagocytic and take up large numbers of these fragments: the lumen is also full of free phagocytes, which are derived from the epithelium. These constitute the "digestive" part of the liver. In other lobules the epithelial cells contain large quantities of highly refringent, resistant granules of unknown chemical nature. These lobules make up the "excretory" part of the liver, which is yellow or brown in colour. The stomach, cœcum and liver contain no recognisable organic material other than wood. In the intestine occasional diatoms are found, but to the author it seems that the histological evidence points to the conclusion that the food of the shipworm is almost entirely wood. Other evidence is given to show the practical independence of this animal of plankton organisms, though the gills of *Teredo* constitute a mechanism by which solid suspended particles can be forwarded to the mouth.

F. A. P.

Note on the British Species of *Anomia*. By R. Winckworth, M.A.

Proc. Malacological Soc., Vol. XV, pp. 32-34, Plate I, 1922.

The shell characters of the species grouped under *Anomia* are very variable, while young individuals are specially difficult to place, as the muscular scars are then very faint. This paper recommends examination of the gills as an aid to discriminating the species, for which purpose a good lens is sufficient. The author recognises four species :—

Anomia ephippium (L.). Upper or left valve with three distinct muscular scars. Gill W-shaped in section, with a depending membranous flap of the outer ascending lamella.

Monia patelliformis (L.). Two distinct muscular scars. Gill W-shaped, without the flap : there are also intermediate ciliary junctions, one in the ascending filaments, two in the descending filaments.

Monia squama (Gmelin) = *Anomia striata* Lovén. The scars of the shell adductor and byssal adductor adjoin one another in the upper valve. Gill similar to that of the last species, but the filaments are finer, and the number of ciliary junctions more numerous ; there are typically two rows on the ascending filaments and three on the descending filaments, but there may be more, as the rows are often irregular.

Heteranomia squamula (L.), including the spinous form *Anomia aculeata* Müller. Two muscular scars in the upper valve, small adjacent but distinct, not radially furrowed as in *Monia*. The gill lamellæ have descending filaments only, each gill being therefore Ω -shaped in section.

All four species occur off Plymouth : material was also obtained from other parts of England and from Scotland.

R. W.